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A SUGAR-FLOTATION METHOD FOR PICKING TROUT EGGS

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The removal of dead trout and salmon eggs by hand picking during incubation can require many man-hours of labor. Use of either malachite green or formalin[1] as a fungicide has reduced the necessity of egg picking (Burrows, 1949). It is still desirable to pick eyed eggs, however, if they are to be shipped to another hatchery. Attempts to facilitate hand-picking by using siphon or suction devices have been made (McMullen, 1948; Smith, 1950).

Salt-flotation for sorting out dead eggs is an old method that is still in use (O'Malley, 1920; Leitritz, 1959; Buss and Fox, 1961). This technique works because dead eggs have a lower specific gravity than live eyed eggs. I believe the salt-flotation method is inefficient and has not been widely used because of two reasons: 1. A salt solution is quite hypertonic, i.e., it causes a rapid loss of water from the eggs. As a result the dead eggs float for only a short period of time before

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[1] Reddecliff, J. Formalin as a fungicide in the jar method of egg incubation. Penn. Fish Comm. 3 pp. 1958 (Mimeo.)

they increase in specific gravity to the extent that they sink. 2. Techniques and equipment that have been used for removal of floating dead eggs are slow and inefficient.

A sugar solution is more efficient than a salt solution for sorting invertebrate organisms from samples of aquatic substrates because it is less hypertonic and the flotation time is longer (Anderson, 1959). For the same reasons a sugar solution is more satisfactory for sorting trout eggs. The longer the dead eggs float, the easier it is to remove them.

My equipment for removing floating eggs is illustrated in Figure 1. A plywood box (29 x 16 x 11 in.) holds the sugar solution. The eggs to be sorted are placed on an egg tray (20.5 x 13.5 in.) that was modified by increasing the thickness of the wooden sides and ends. A rectangular metal frame (6 in. high), which confines the floating eggs, was constructed to fit inside the edge of the egg tray. A metal ledge along each side near the bottom of the metal frame prevents the lower edge from resting on the screen of the egg tray and possibly breaking eggs. Floating eggs are removed with a curved metal net. If eggs are to be removed efficiently, the sides of the metal frame must be straight and parallel. The width of the net must be slightly less than the inside width of the metal frame.

The procedure which has proven effective for sorting trout eggs is as follows: At least 24 hours prior to sorting, the eyed eggs are physically "shocked" in order to rupture the yolk membrane of the infertile eggs. The infertile eggs turn white. The difference in specific

Figure 1.--Equipment for the flotation removal of dead trout eggs, including: the water-tight box which holds the sugar solution, the egg tray, the sheet-metal frame which keeps the eggs on or over the tray, and the screen scoop which is used in skimming off the dead eggs.

gravity between good eggs and infertile or dead eggs is greater 24 to 48 hours after shocking than immediately afterward. The difference in specific gravity between dead and eyed eggs is also greater when the eggs are well eyed. The efficiency of the method is related to these differences in specific gravity.

To prepare the sugar solution, the plywood box is filled with water to a depth of about 6 inches. Sugar is added and stirred into the solution until the proper strength is reached. The amount of sugar to be used can best be determined by trial and error with a few eggs on the screen tray. It varies depending on water temperature and on the age, species, and size of eggs to be sorted. The sugar solution is of the right strength when the dead eggs float and the live eggs sink; it is too strong if all eggs float, too weak if all eggs sink. The difference in specific gravity between good and bad eggs is rather small; thus the proper solution can be obtained only by patience and experience.

After a satisfactory solution is obtained, approximately 20 to 30 ounces of eggs are placed on the special screen tray. The tray will hold a larger volume if the eggs are large. The metal frame to confine the eggs is then put in position and the tray is tipped so that the eggs roll into one corner to drain; it is desirable to drain excess water from the eggs so that dilution of the sugar solution is minimized. The eggs are then redistributed evenly over the tray and the tray is submerged in the sugar solution. After a few seconds the good eggs have settled and the bad eggs are at or near the surface; the floating eggs are then

removed with the metal net. The good eggs are transferred to a regular egg tray and placed in a trough. Any dead eggs which were not removed by flotation are picked by hand. The eggs in the metal net are emptied into a floating net held in water. A small percentage (less than 5 percent) of the eggs removed by flotation will be good eggs. These can be salvaged by placing all of the eggs removed by flotation back in the incubation system and continuing with the incubation and fungus treatment until the fry are hatched. (Formalin is recommended as a fungicide for hatching eggs because it is less toxic to fry than is malachite green.)

Additional sugar is added to the solution as required to compensate for dilution. The same solution can be used several days if it is kept cool.

Efficiency of the sugar-flotation method in removing dead eggs depends on the time lapse after shocking, the degree of egg development, the species of fish, and the egg size. Large eggs are easier to sort because they have less surface area per unit of volume, lose water less rapidly, and thus float longer. For some unknown reason rainbow trout eggs are harder to sort than those of brown, brook, or lake trout. This may be related to the permeability of the egg membrane to water and the rate of water loss. (Water that is lost from the eggs by osmosis while in the sugar solution is replaced when the eggs are again put in fresh water.)

Typical results that have been obtained by sorting eggs with sugar-flotation are presented in Table 1. I believe that the flotation technique does not damage the developing embryo, for no mortality,

Table 1.--The percentage of dead eggs removed from several samples of trout eggs by flotation in a sugar solution

Species	Eggs per ounce	Dead eggs removed (percent)	Average (percent)
Brook trout	294	92, 93	92
Brown trout	185	92, 93, 94, 97	94
Brown trout	270	91, 93, 94	93
Brown trout	480	83, 85	84
Rainbow trout	220	85, 86, 90	87

abnormality, or loss of fry has been attributed to the procedure after two years of using the method. The man-hours saved by the flotation technique depends on the percentage of dead eggs to be removed and the factors influencing the length of the flotation time. It has been my experience that with sugar-flotation, eggs can be picked in about 10 percent of the time required for the usual hand-picking procedure.

Acknowledgments

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